STUDY ON THE SPREAD OF RAGWEED (AMBROSIA ARTEMISIIFOLIA L.) ON CEREAL STUBBLE

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Abstract: The study was carried out in 2014 in Keszthely, Hungary. The experiment was set up on a Ramann-type brown forest soil (Eutric cambisol). The GNSS system guaranteed a precision of minimum 5 cm. The studied 4 hectare area was chosen from a 20 hectare field of Mosóházi-Dűlő. The 30 measurement points had been identified with the help of the data of the Georgikon Mapserver and the basis of previous measurements. The ArcGIS 10.1 software had been used for creating new layers and points similarly to previous measurements. For identifying the date of the measurement, the agricultural and technical conditions as well as the constellation of the GPS satellites were taken into consideration. All aboveground plant parts of every ragweed from each sample area ($1m^2$) were collected and the fresh-, dry biomass and density were measured. The statistical processing of data was performed by Microsoft Excel. The spread of *A. artemisiifolia* changed in a wide range within the stubble. The abundance varied between 0 and 41 pieces$\cdot m^{-2}$. The fresh and dry weight also varied considerably. The species has been demonstrated a significant correlation between the density and dry weight of the biomass. The AL-K_2O content of soil was widely varied between 107 and 242 $mg\cdot kg^{-1}$, and the AL-P_2O_5 content was also in a wide range in the sample area, between 143 and 1544 $mg\cdot kg^{-1}$.

Keywords: *Ambrosia artemisiifolia*, biomass, cereal stubble, GNSS-GIS system, spread

Introduction

The invasion of *A. artemisiifolia* into Europe proceeded in two stages: *A. artemisiifolia* was inadvertently introduced into Europe in the 19th century and has become a widespread alien species in South-eastern Europe (Chauvel et al., 2006). The plant was identified by Lengyel in Hungary in 1920 in Somogy County (Béres and Hunyadi, 1991). *Ambrosia artemisiifolia* L. ranked 23rd on the list of the most important on arable fields at the first National Weed Survey (NWS) of Hungary, which was conducted between 1947 and 1953 (Ujvárosi, 1973). Ragweed was identified as the No. 1. weed at the 4th NWS (1996-1997) and remains the most dangerous weed on arable fields according to the 5th NWS (2007-2008) *A. artemisiifolia* is the most important weed of wheat stubbles and maize at the end of summer (Novák et al., 2009). In the last decade many expanding populations of *A. artemisiifolia* in Central and Northern Europe have been evidenced (Alberternst et al., 2006). Climate change and invasive species are regarded as major threats to biodiversity (Pompe et al., 2008, Bossdorf et al., 2005). Invasive species may induce economic problems, particularly in agriculture and forestry (Bossdorf et al., 2005). When considering *A. artemisiifolia*, the main problem is the health risk for human population. Some invasive species may be promoted by climate change (Thuiller et al., 2007) due to characteristics that facilitate rapid range shifts (e.g., short time to maturity and low seed mass) and due to their broad climatic tolerances (Hellmann et al., 2008).

Spatial data databases and their metadata give a whole novel way to analyse agricultural databases. Spatial and elevation aspects have been involved in the evaluation, which ensures an excellent opportunity for the evaluation even in the case of long term time

 DOI:10.12666/Novenyterm.64.2015.Suppl

lines. The applied GNSS-GIS methods have made it possible to visualise the variety and density of different parameters within the area.

Materials and methods

The study was carried out in 2014 in Keszthely, Hungary. The experiment was set up on a Ramann-type brown forest soil (Eutric cambisol) (Lehoczky et al., 2009). All aboveground plant parts of every ragweed from each sample area were collected from a 1 m^2 area, and the fresh and dry weights were measured. Statistical data processing was performed by Microsoft Excel. The GNSS system guaranteed a precision of minimum 5 cm. The spatial data needed for the technical planning of the measurements were supplied by topographic map and remote sensing data service of the Georgikon Mapserver (Busznyák, 2004). Further information can be found at. Our examinations were carried out on the territory of the Georgikon Tanüzem LTD. in Keszthely, Hungary. The 4 hectare area was chosen from a 20 hectare field of Mosóházi-Dűlő. The 30 measurement points had been identified with the help of the data of the Georgikon Mapserver and on the basis of previous measurements. The ArcCatalog and ArcMap modules of ArcGIS 10.1 software had been used for creating new layers and point similarly to previous measurements. When identifying the date of the measurement, the agricultural and technical conditions as well as the constellation of the GPS satellites were taken into consideration. For data collection, the Trimble 5800 GPS rover device was used, which is capable of dual phase real time kinematic measurement, with a TSC2 12.22 version software survey controller. For receiving correction data, Trimble CMR+ format was applied, with a set maximum PDOP value of 6, frequency of 10 Hz and elevation cutoff of 5 degrees. HD72 EOV coordinate/date was applied, and Hungary9 geoid model was used for vertical equalisation. As measurement method, while forming the boundaries and identifying features of the ground, RTK continuous topographic measurement was used with time intervals set for 1 second. While identifying sample collection places, 5-second RTK point measurement was chosen. The online correction data were accessed through the Georgikon GNSS Base Station, at the CMR+ GPSBase stream from Georgikon Bas at http://gnss.georgikon.hue Station via T-mobile GPRS service. Further information. The GIS procession was carried out using the ESRI ArcGIS 10.1 system. Geodatabases and shape files were used as well. The 3D model of the area was created from data obtained from measurements in 2009 and 2014 Real Time Kinematic Continous Topo and Real Time Kinematic point measure with ArcInfo Topo to Raster interpolation module. The PointElevation basic interpolation was created by a Boundary cutoff of 1 m pixel. For spatial figures, the ArcInfo ArcScene component was applied.

Results and discussion

The organic matter content of the soil of the sample area was widely varied, between 1.2 and 1.96%. In the case of Ramann-type brown forest soil (Eutric cambisol). The AL-K_2O content of soil was widely varied between 107 and 242 mg·kg^{-1}, and the AL-P_2O_5 content was also in a wide range in the sample area, between 143 and 1544 mg·kg^{-1} (*Table 1*). 1544 mg·kg^{-1} was extremly high level of phosphorus. Based on the results, the soil humus content supply was medium on 67% and low on 33% of the sample points. The soil nutrient supply was medium. The phosphorus supply was very good and the potassium supply was medium of the sample points. The data were analysed based on Füleky's work (1999).

Table 1. Soil properties of the experimental field

	OM[a] (%)	AL-K_2O^b (mg·kg^{-1})	AL-$P_2O_5{}^b$(mg·kg^{-1})
Min. value	1.24	107.0	143.0
Max. value	1.96	242.0	1544.0
Mean (n=30)	1.59	147.8	490.2
St. deviation (+/-)	0.16	31.6	313.9

a: [1]MSZ-08-0210-1977; b: MSZ-20135-1999; Egner et al. 1960

The spread of *A. artemisiifolia* changed in a wide range within the stubble. The abundance varied between 0 and 41 pieces·m^{-2}. The fresh biomass weight of *A. artemisiifolia* within the area varied between 1 and 104 g·m^{-2}. Between the minimum and maximum weight of more than a hundred times was the difference. The dry biomass weight also varied considerably (*Table 2*). The water content of ragweed varied between 87 and 97%.

Table 2. Density, biomass and water content of *A. artemisiifolia*

	Min. value	Max. value	Mean	St. dev. (+/-)
Density (plant·m^{-2})	0.0	41.0	12.7	10.1
Fresh biomass (g·m^{-2})	1.0	104.0	35.1	28.4
Dry biomass (g·m^{-2})	0.1	11.9	3.6	3.1
Water content (%)	87.0	97.3	90.6	2.8

This was also proven by the correlation between the density and biomass production of *A. artemisiifolia*, which can be descrideb with the help of a desribed linear function as follows: y=0.2306x+0.4191; r=0.7475; n=30; p<0.01 (*Figure 1*).

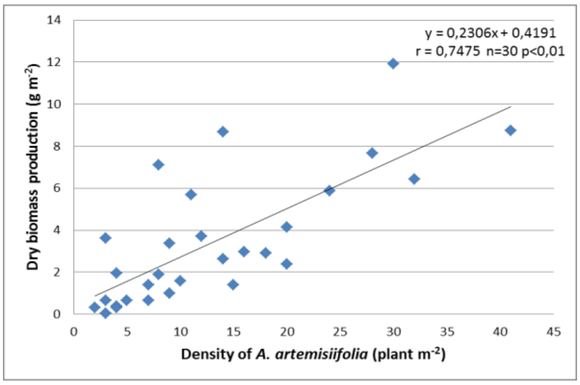

Figure 1. Corelation between the plant density and the dry biomass weight (g·m^{-2}) of *A. artemisiifolia*

Based on this correlation, it can be stated that the biomass production was growing parallel with the plant number of young ragweed.

 DOI:10.12666/Novenyterm.64.2015.Suppl

Conclusions

The study was carried out in 24-25. July 2014 in Keszthely, Hungary. The sample area has Ramann-type brown forest soil (Eutric cambisol). The studied 4 hectare area was chosen from a 20 hectare field of Mosóházi-Dűlő. The 30 measurement points had been identified with the help of the data of the Georgikon Mapserver and the basis of previous measurements. The research was based on a study from 2009. Winter barley was sawn in 2014 in the area. The GIS-GNSS system was well applicable with the spread, biomass quantity and nutrient content examinations.

Three weeks after the winter barley harvest small number of ragweed (*A. artemisiifolia* L.) individuals occurred on the area, the average density was 12.70 pieces$\cdot$m^{-2} (0-41 pieces$\cdot$m^{-2}), fresh biomass weight varied between 1 and 79 g$\cdot$m^{-2}, dry biomass weight varied between 0.05 and 8.75 g$\cdot$m^{-2}. The species has been demonstrated a significant correlation between the density and dry weight of the biomass.

Acknowledgements

The authors would like to express thanks to Hungarian Scientific Research Fund (OTKA) for supporting the research. Project No. OTKA (K-105789).

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